CALIBRATION STANDARD REQUIREMENT

FOR A

MICROWAVE POWER AMPLIFIER

* * * * * * * * * * *

PROCUREMENT PACKAGE

Prepared by: Naval Warfare Assessment Division
Measurement Science Directorate
Code MS-33
Corona, CA 91718-5000

July 1995
Encl (1)

CALIBRATION STANDARD REQUIREMENT FOR A MICROWAVE POWER AMPLIFIER

1. SCOPE

1.1 Scope. This requirement defines the mechanical and electrical performance requirements for a Microwave Power Amplifier, hereinafter refer to as the MPA. The MPA provides leveled output power from 2.0 to 20 GHz a levels up to 19 dBm. The MPA provides General Purpose Interface Bus (GPI capabilities in accordance with IEEE-STD-488. The MPA is intended for use shipboard and shorebased Navy personnel in association with calibrati equipment used to calibrate microwave-power-measurement instruments a spectrum analyzers.

2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military requirement, Test Equipment for use with Electrical and Electronic Equipment, Genera specification for," and all documents referenced therein of the issues effect on the date of this solicitation shall form a part of this requireme

3. REQUIREMENTS

3.1 General. The MPA shall conform to the Type II, Class 5, Style E requirements as specified in MIL-T-28800 for Navy shipboard and shorebased as modified below.

3.1.1 Design and Construction. The MPA design and construction shall meet the requirements of MIL-T-28800 for Type III equipment.

3.1.2 Power requirements. The MPA shall operate from a source of 103.5V to 126.5V at 60Hz (5% single phase input power as specified in MIL-T-28800.

3.1.2.1 Fuses or Circuit Breakers. Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source sha be automatically disconnected from the equipment in the event of excessi current. If fuses are used, only the line side of the input power line, defined by MIL-T-28777, shall be fused. Fuses or circuit breakers shall readily accessible.

3.1.2.2 Power Connection. The requirements for power source connections shall be in accordance with MIL-T-28800 with a 6 foot (1.8 m) minimum leng cord.

3.1.3 Dimension and Weight. Maximum dimensions shall not exceed 8.4 inches (21.3 cm) in width, 5.2 inches (13.2 cm) in height, and 14.4 inc (36.6 cm) in depth. The weight shall not exceed 31 pounds (14 kg).

3.1.4 Lithium Batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval for the use of lithi batteries, including those encapsulated in integrated circuits, shall submitted to the procuring activity at the time of submission of proposal Approval shall apply only to the specific model proposed.

3.2 Environmental Requirements. The MPA shall meet the environmental requirements for a Type II, Class 5, Style E equipment with the deviatio specified below.

3.2.1 Temperature and Humidity. The MPA shall meet the conditions below.

	Temperature(°C)	Relative Humidity(%)
Operating	10 to 30	95
	30 to 40	75
Non-operating	-40 to 70	Not controlled

3.2.2 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE CS01, CS02, CS06, RE01, RE02 (14 kHz to 1 GHz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The MPA shall have an 85% or greater probability of remaining within tolerances of all requirements at the end of a 12 mon period.

3.4 Maintainability. The MPA shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete compon shall be defined as a replaceable assembly. Certification time shall n exceed 60 minutes.

3.5 Performance Requirements. The MPA shall provide the following capabilities. Unless otherwise indicated, all performance requirements sh be met following a 30-minute warm-up period, over the temperature range +10(C to +40(C.

3.5.1Output Power. The minimum amplifier output power shall be the following at +5 dBm input.

Carrier Frequency	Minimum Output Power (leveled output)	Minimum Output Power (unleveled output)
2 GHz to 18.6 GHz	+ 19 dBm	+ 20 dBm
18.6 GHz to 20 GHz	+ 17 dBm	+ 18 dBm

3.5.1.1 Output Power Display Accuracy. The amplifier RF output power display uncertainty shall be no greater than (1.5 dB over the range from +0 dBm to +20 dBm for CW input signals or for full band power times that are greater than 4 seconds.

3.5.2 Power Flatness. The MPA RF-output leveled power flatness shall be less than (1.25 dB.

3.5.3 1 dB Compression Point. The MPA 1 dB compression point shall be (+20 dBm.

3.5.4 Minimum Small Signal Gain. The MPA minimum small signal gain with a -5 dBm level input shall be as follows.

Carrier Frequency	Gain
2 to 18.6 GHz	15 dB
18.6 to 20 GHz	13 dB

3.5.5 Output Power Temperature Stability. The MPA output temperature stability shall be less than 0.1 dB/(C.

3.5.6 Impedance. The MPA shall have a nominal RF-input and RF output impedance of 50 ohms.

3.5.7 Voltage Standing Wave Ratio (VSWR). The MPA RF input and RF output shall be the following.

Carrier Frequency	RF Input VSWR	Leveled RF Output VSWR
2 GHz to 18.6 GHz	(2.8:1	(2.5:1

3.5.8 RF Connectors. The MPA RF output and RF input connectors shall be located on the front panel.

3.5.9 Minimum Non-Destructive Input Levels. The minimum input levels allowed before damage could occur shall be as follows.

Microwave Power	DC Voltage
+27 dBm	(10 V dc

3.5.10 Harmonics. The MPA shall have the following characteristics at maximum specified output power, with respect to spurious signals which are harmonics of the carrier.

Carrier Frequency	Spurious Signal Level
2 GHz to 11 GHz	(-20 dBc
11 GHz to 20 GHz	(-30 dBc

3.5.11 Non-Harmonics. The MPA shall have less than -55 dBc of spurious-signal output which are not harmonics of the carrier, at maximum specified output power.

3.5.12 Intermodulation Distortion. The MPA shall have a nominal third order intercept of +33 dBm.

3.5.13 Positive Z Blanking Input. The MPA shall be provided with a positive Z blanking input, through a type BNC female connector, on the rear panel. A signal applied to this input shall hold the MPA's LED power display, and the external display, while the swept source passes switch points and retraces.

3.5.14 0.5 V/GHz Input. The MPA shall be provided with a BNC connector on its rear panel that will provide a voltage that is proportional to the frequency of the microwave source (0.5 V/GHz). This voltage will be used by the MPA to provide internal-power flatness corrections.

3.5.15 Detector Output. The MPA shall be provided with an approximate -10 mV/mW output through a type BNC female connector on the rear panel for use when leveling.

3.5.16 Millimeter-Source-Module Interface. The MPA shall be provided with a 20 pin B connector Source-Module Interface on the rear panel. The MPA Sou Module Interface shall be electrically, mechanically and functionall compatible with the Input Control Cable from the U.S. Navy owned Hewle Packard 83550-series Millimeter Wave-Source Modules. The MPA Source Modu Interface shall provide the DC bias and control signals from the MPA to t millimeter wave source modules via the control cable and shall input level and other signals back from source modules.

3.5.17 Output Power Display. The MPA shall provide a front panel digital display of RF output power.

3.5.18 Compatibility. The MPA shall be electrically, mechanically and functionally compatible with the Input Control Cable from the U.S. Navy ow Hewlett-Packard HP 8350B/83590-Series Sweep oscillators and the H 8340B/8341B-Series Synthesized Sweepers.

3.6 Operating Requirements. The MPA shall provide the following capabilities.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The location and labeling of indicato controls and switches shall provide for maximum clarity and easily underst operation without reference to tables, charts or flow diagrams.

3.6.2 Standby/Operate. A STANDBY/OPERATE and/or RF ON/OFF switch shall be provided.

3.6.3 Error Correction. During calibration, the MPA shall provide the capability to accept and store corrections for all measurement deviations f nominal conditions. The MPA shall meet all the specified performanc specifications without requiring additional entry of any calibration factor other correction data.

3.6.4 Self Test. The self test shall determine operational readiness and isolate faulty modules.

3.6.4.1 Display. If the self test fails, the display shall indicate the nature of the failure and provide directions for diagnostic action.

3.7 Digital Interface. The MPA shall provide a digital interface as specified in MIL-T-28800 and IEEE-488 General Purpose Interface Bus (GPIB).

3.7.1 Remote Programming Requirements. All modes, functions, and inputs/outputs of the MPA shall be remotely programmable over the IEEE-4 General Purpose Interface Bus (GPIB).

3.7.2 GPIB Capabilities. The following IEEE-488 capabilities shall be provided:

T6 or TE - Talker,
L4 or LE4 - Listener,
SR1 - Service request,

3.7.3 Status Register Access Requirements. Access to status register shall be available via the IEEE-488 bus to ascertain MPA mode, range and oth operational and error status.

3.7.4 Bus String Terminator Requirements. Terminators for a string of bus commands shall be a carriage return followed by line feed and EOI signal.

3.7.5 Bus Address Switch. Address must be selectable without removing any covers.

3.7.6 Bus Error Handling Requirements. Bus error reporting and recovery conventions shall be fully described in the Operation and Maintenance Manua

3.7.7 Compatibility. The MPA, when used as part of an automated system, shall be capable of automatically energizing and /or calibrating applicab test instruments and measurement systems that are IEEE-488 bus configure The MPA shall be compatible with the Fluke 1722A and 1722A/AP Instrume Controllers.

3.8 Accessories. The following accessories shall be provided with each MPA.

3.8.1 Power Cable. One power cable in accordance with MIL-T-28800, with minimum length of 6 feet (1.8 m).

3.9 Manual. At least two copies of an operation and maintenance manual shal be provided. The manual shall meet the requirements of MIL-M-7298.

3.9.1 Calibration Procedure. A calibration procedure in accordance with MIL-M-38793 shall be provided.